

Space Radiation Protection, Space Weather, and Exploration

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Management of crew exposure to radiation is a major concern for manned spaceflight – and will be even more important for the modern concept of longer-duration exploration. The inherent protection afforded to astronauts by the magnetic field of the Earth in Low Earth Orbit (LEO) makes operations on the space shuttle or space station very different from operations during a deep space exploration mission. In order to experience significant radiation-derived Loss of Mission (LOM) or Loss of Crew (LOC) risk for LEO operations, one is almost driven to dictate extreme duration or to dictate an extreme sequence of solar activity. Outside of the geo-magnetosphere, however, this scenario changes dramatically. Exposures to the same event on the ISS and on the surface of the Moon may differ by multiple orders of magnitude. This change in magnitude, coupled with the logistical constraints present in implementing any practical operational mitigation make situational awareness with regard to space weather a limiting factor for our ability to conduct exploration operations.

With these differences in risk to crew, vehicle and mission in mind, we present the status of the efforts currently underway as the required development to enable exploration operations. The changes in the operating environment as crewed operations begin to stretch away from the Earth are changing the way we think about the lines between “research” and “operations”. The real, practical work to enable a permanent human presence away from Earth has already begun.